

Appl. No. 09/997,084
Amendment dated October 18, 2004
Reply to Office Action mailed June 17, 2004

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (currently amended): An infrared lamp comprising:

a carbon-based heating element obtained by the process comprising:

firing a mixture of a carbon composition having compactibility and a carbon yield of substantially nonzero after firing and at least one kind of metallic or semi-metallic compound to form a carbon-based heating element and

reheating said carbon-based heating element in a vacuum, to set the change rate of the electric specific resistance of said carbon-based heating element at a high temperature in lit state with respect to electric specific resistance at a normal temperature in unlit state in the range from -20% to +20%

lead wires electrically connected to both ends of said carbon-based heating element to current passing portions of said carbon-based heating element via cylindrical connection members composed of a carbon-based substance having an inherent resistance smaller than that of said carbon-based heating element and larger than that of said lead wires, and

a sealed quartz glass tube filled with a gas and accommodating said carbon-based heating element so that the ends of said lead wires extend outside said sealed quartz glass tube.

Claim 2 (previously presented): An infrared lamp in accordance with claim 1, wherein the metallic or semi-metallic compound included in said carbon-based heating element is at least one compound selected from the group consisting of metallic carbide, metallic boride, metallic

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silicide, metallic nitride, metallic oxide, semi-metallic nitride, semi-metallic oxide and semi-metallic carbide.

Claim 3 (previously presented): An infrared lamp in accordance with claim 1, wherein said carbon-based heating element includes resins.

Claim 4 (previously presented): An infrared lamp in accordance with claim 1, wherein said carbon-based heating element includes at least one powder selected from the group consisting of carbon black, graphite and coke powder.

Claims 5-6 (cancelled).

Claim 7 (currently amended): An infrared lamp in accordance with claim 5 1, wherein said lead wire comprises a metal selected from the group consisting of tungsten, molybdenum and stainless steel.

Claim 8 (currently amended): An infrared lamp in accordance with claim 5 1, having a coil spring on at least one of said lead wires to apply a tension to said carbon-based heating element, wherein said coil spring has a diameter substantially equal to the inner diameter of said quartz glass tube.

Claim 9 (currently amended): An infrared lamp in accordance with claim 5 1, wherein said

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quartz glass tube is filled with a gas selected from the group consisting of argon, nitrogen and a mixture of argon and nitrogen.

Claim 10 (previously presented): An infrared lamp comprising:

a heating element having a sintered body made of a carbon-based element comprising a plurality of heating elements connected in series via cylindrical connection terminals wherein said cylindrical connection terminals radiate heat and are tightly fitted to said plurality of heating elements at a recess,

electrode terminals connected to both ends of said heating element, and

a heating element assembly comprising internal lead wires connected on one end to said electrode terminals and connected on another end to one end of an intermediate terminal plate.

Claim 11 (previously presented): An infrared lamp in accordance with claim 10, wherein said heating element assembly is inserted into a heat-resistant transparent glass tube, said intermediate terminal plates are sealed in sealing portions of said heat-resistant transparent glass tube, and external lead wires extending outside said heat-resistant transparent glass tube are connected to ends of said intermediate terminal plate.

Claim 12 (previously presented): An infrared lamp comprising:

a plurality of heating elements each formed of a sintered body including a carbon-based substance

electrically-conductive, heat-radiating electrode terminals disposed at both ends of each

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of the plurality of heating elements wherein said electrode terminals have a recess portion into which said plurality of heating element are inserted, and

a heating element assembly obtained by connecting at least one electrode terminal of a heating element to at least one electrode terminal of another heating element via a connection terminal thereby forming a long heating element, by connecting said electrode terminals at both ends of said long heating element to one end of internal lead wires, and by connecting the other end of said internal lead wires to intermediate terminal plates.

Claim 13 (previously presented): An infrared lamp in accordance with claim 12, wherein said heating element assembly is inserted into a heat-resistant transparent glass tube, said intermediate terminal plates are sealed at sealing portions of said heat-resistant transparent glass tube, and external lead wires extending outside said heat-resistant transparent glass tube are connected to the other ends of said intermediate terminal plates.

Claim 14 (previously presented): An infrared lamp in accordance with claim 12, wherein at least one of said connection terminal and said electrode terminals are formed of a sintered body including a carbon-based substance.

Claim 15 (previously presented): An infrared lamp in accordance with claim 12, wherein said connection terminal is formed from at least one of a coil-shaped tungsten-based substance and a coil-shaped molybdenum-based substance.

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Claim 16 (previously presented): An infrared lamp in accordance with claim 13, wherein said heat-resistant transparent glass tube enclosing said heating element is filled with a gas selected from the group consisting of an inert gas and nitrogen gas.

Claim 17 (previously presented): An infrared lamp in accordance with claim 14, wherein said connection terminal has a shape being concentric with said heating element and said heat-resistant transparent glass tube, and is disposed so that a predetermined clearance is provided between said connection terminal and an inner wall of said heat-resistant transparent glass tube.

Claim 18 (previously presented): An infrared lamp in accordance with claim 10, wherein said heating element assembly is formed of a plurality of heating elements having different heating values.

Claim 19 (previously presented): An infrared lamp comprising:

a long heating element obtained by connecting a plurality of heating elements, in series via connection terminals, said heating elements being formed of a sintered body including a carbon-based substance,

electrode terminals connected to both ends of said long heating element, and

a heating element assembly obtained by electrically connecting one end of internal lead wires to said electrode terminals and by connecting the another end of said internal lead wires to one end of intermediate terminal plates, wherein said heating element is a plate-shaped heating element, the cross-sectional shape of said plate-shaped heating element is a rectangle, the ratio of

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the thickness to the width of the rectangle is 1:5 or more, and the direction of the longer side of the rectangular cross-section of at least one of said plurality of plate-shaped heating elements is different from those of the other plate-shaped heating elements.

Claims 20-22 (cancelled)

Claim 23 (currently amended): An infrared lamp comprising:

a plurality of terminals on at least one carbon-based ~~wire-shaped~~ heating element ~~formed of a sintered body including a carbon-based substance~~, wherein said carbon-based heating element has an electric specific resistance in a lit state with respect to electric specific resistance in an unlit state between -20% and +20%.

electrode terminals connected to both ends of said carbon-based heating element, and,
internal lead wires connected on one end to said electrode terminals and connected on another end to intermediate terminal plates.

Claim 24 (currently amended): An infrared lamp in accordance with claim 23, wherein said at least one carbon-based heating element ~~assembly~~ is inserted into a heat-resistant transparent glass tube, said intermediate terminal plates are sealed at the sealing portions of said heat-resistant transparent glass tube, and external lead wires extending outside said heat-resistant transparent glass tube are connected to the other ends of said intermediate terminal plates.

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Claim 25 (currently amended): An infrared lamp in accordance with claim + 23, wherein more carbon is contained in the surface layer than in the inside of said at least one carbon-based heating element.

Claim 26 (previously presented): A warming apparatus provided with a plurality of infrared lamps in accordance with claim 25 in at least one of the upper, lower and side positions of the housing of said apparatus.

Claim 27 (previously presented): A drying apparatus provided with a plurality of infrared lamps in accordance with claim 25 in at least one of the upper, lower and side positions of the housing of said apparatus.

Claim 28 (previously presented): A heating apparatus provided with a plurality of infrared lamps in accordance with claim 25 in at least one of the upper, lower and side positions of the housing of said apparatus.

Claim 29 (previously presented): A cooking apparatus provided with a plurality of infrared lamps in accordance with claim 25 in at least one of the upper, lower and side positions of the housing of said apparatus.

Claim 30 (previously presented): A medical apparatus provided with a plurality of infrared lamps in accordance with claim 25 the upper, lower and side positions of the housing of said apparatus.